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GB 856112
GB 725115
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# (54) Method of making molded article of synthetic resin, article molded thereby and insert member for making same

(57) A molded article (2) of synthetic resin is made by injection molding. A three dimensional pattern or letter (1a) is embossed on the surface of the article at the same time as the article is made by use of a female mold (3) engraved with the desired pattern or letter. An insert member (1) is positioned on the pattern or letter engraved on the female mold (3), and a male mold (4) is positioned over the female mold (3) to form a cavity. A synthetic resin is injected into the cavity through a sprue (6), whereby the insert member (1) is deformed under the injection moulding pressure to form the pattern or letter (1a) on the article (2). The insert member (1) is a laminate formed of a flexible metal layer which is deformable under the injection molding pressure, and a layer of material which melts under the injection molding temperature.

FIG.1

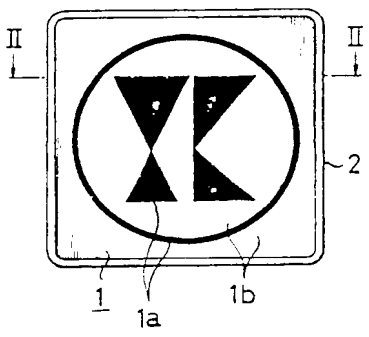


FIG.4

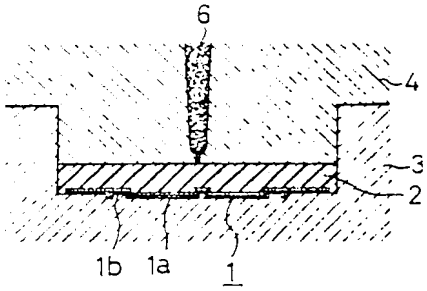


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FIG.1



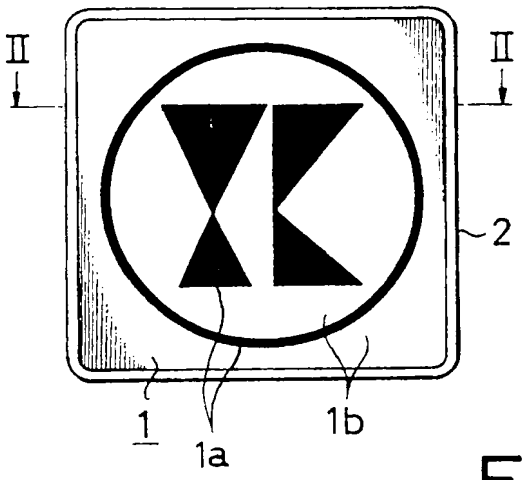


FIG.2

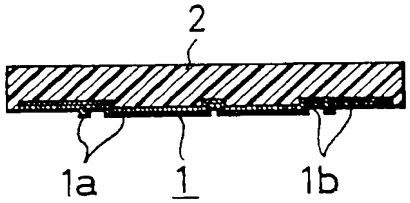


FIG.3

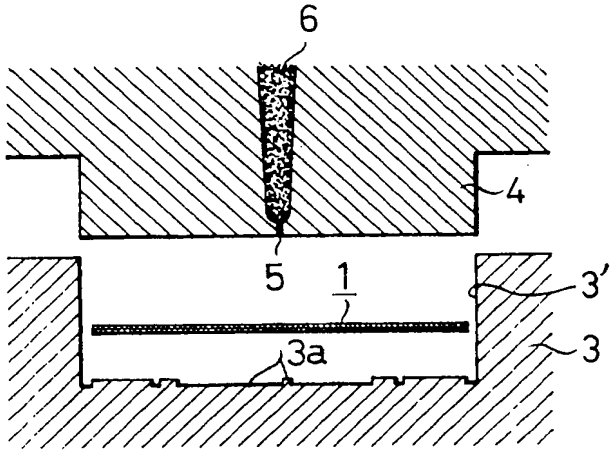


FIG.4

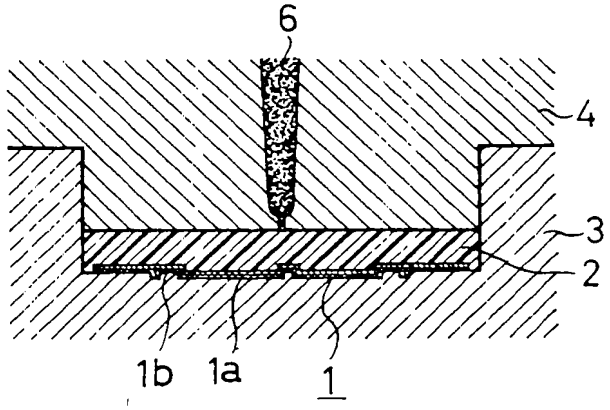


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FIG.5a

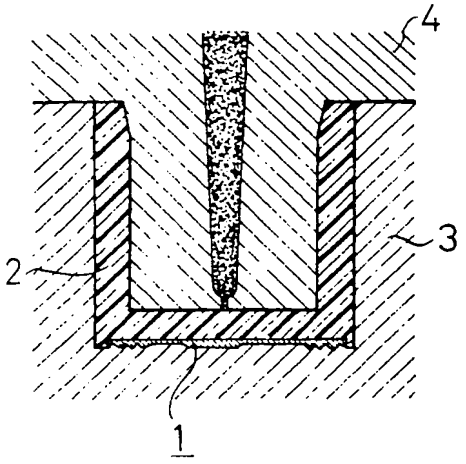



FIG.5b

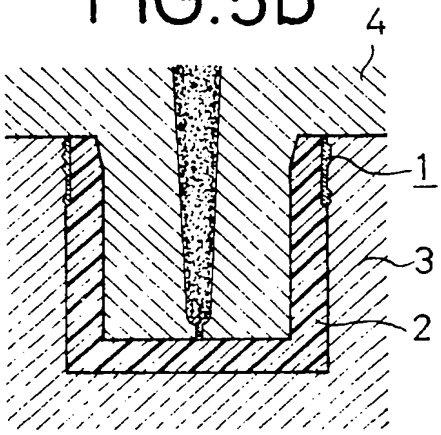



FIG.5c

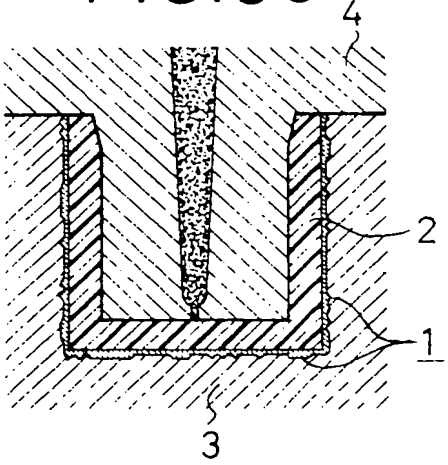



FIG.5d

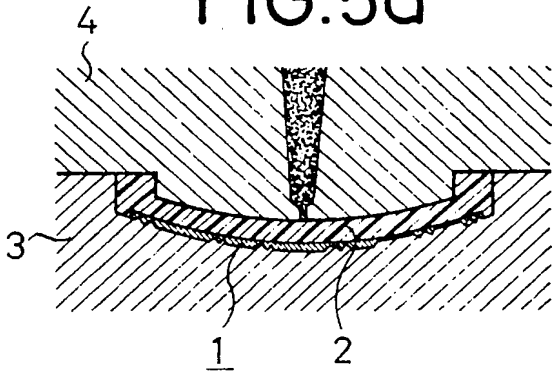
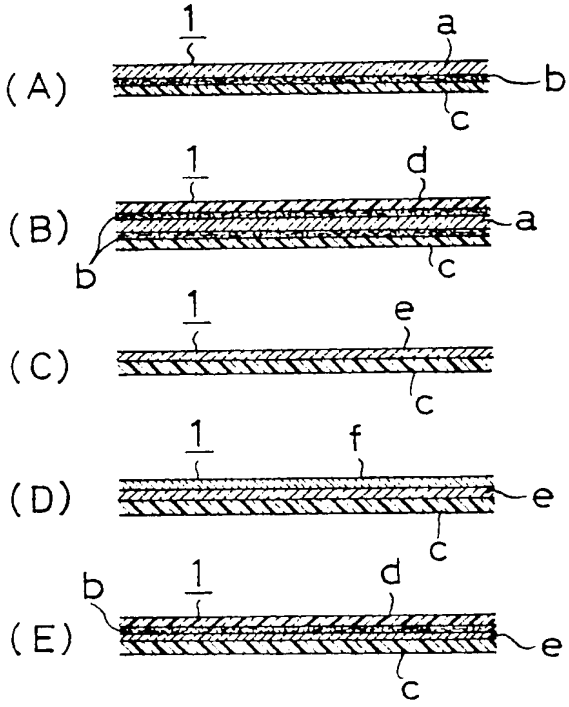



FIG.6



SPECIFICATION

# Method of making molded article of synthetic resin, article molded thereby and insert member for making same

The present invention is directed to a method of forming an embossed three dimensional pattern or letter on the desired face portion of a molded article simultaneously with the molding thereof, by effecting injection molding with the use of an insert member comprising a pressure sensitive and fusible plate which can be plastically deformed to be fused under the injection pressure and temperature for molding a main body of a molded article from a matric resin.

In general, a metal plate, for example an ornament or name plate made of a metal, has been often adhered to and secured on the surface of a molded article in order for presenting the same with a beautiful appearance and for improving the commercial value thereof according to the conventional method. However, although a flat ornament may be form by the conventional method, a three dimensional or stereoscopic ornament can not be formed thereby.

There has been proposed a method of forming a three dimensional pattern or letter on a molded article by engraving said metal plate or the like on a press to form a pattern thereon and then simply adhering the plate to the molded article. However, this method is not yet a convenient means, since it requires cumbersome manufacturing operations and the adhesive strength of the manufactured product is poor. Also, there has been known a method of forming a surface pattern in concave-convex planes during the injection molding step for the molded article by means of a mold, and applying a layer of a transfer foil or a coating layer, respectively, by hot-stamping or coating on either of the concave or convex plane to present a stereoscopic appearance. However, the former mentioned hot-stamping method is disadvantageous in that the heater body for hot-pressing the foil on the upside face of the article is heated to a high temperature in its entirely so that the foil tends to be transferred and adhered to the area other than the predetermined or desired position; and the latter mentioned coating method has a disadvantage that the coating is adhered to the area other than the predetermined position, which necessitates a troublesome operation, i.e. a wiping-off operation, and additionally a clearly finished pattern cannot be formed thereby.

The present invention provides a method of making a molded article of synthetic resin, an article molded thereby and an insert member for making the same by means of an injection molding method using the insert member comprising a pressure sensitive and fusible plate which can be plastically deformed to be fused by the actions of injection pressure and heat emitted from the matrix resin for the molded article (the plate being referred to as pressure sensitive and fusible plate in the present invention), whereby an embossed three dimensional pattern or letter having the metallic color tone is formed on the desired portion of the surface of the molded article concurrently with the molding operation. The present invention may be practised for presenting beautiful ornament patterns or letters easily and securely on molded articles of synthetic resin such as ornament plates, various containers, cases and caps.

The objects, features and advantages of the present invention will be apparent from the following description of the preferred embodiments thereof with reference to the appended drawings in which Figure 1 is a front elevation of one embodiment of the molded article according to the invention; Figure 2 is a sectional view taken along line II - II of Figure 1; Figures 3 and 4 are sectional views showing the method of making the molded article of Figure 1; Figures 5*a* and 5*b* are sectional views showing the method of making another molded article embodying the invention; and Figures 6(A) to 6(E) are enlarged sectional views showing preferred structures of pressure sensitive and fusible plates (insert members) used in the method of the invention.

The pressure sensitive and fusible plate, i.e. the insert member used in the method of the present invention, will be described firstly for facilitating to understand the invention in detail.

In Figures 6(A) to 6(E), examples of the pressure sensitive plate are shown and denoted generally at 1, which may include an aluminium foil or very thin aluminium plate *a* (hereinafter referred to as aluminium foil), an interposed binder layer *b* of an adhesive, a synthetic resin film or very thin plate of a synthetic resin *c* (hereinafter referred to as resin film), a coating film *d* of a synthetic resin or the like, a hot-stamped layer or evaporation plating layer *e* of a metal (hereinafter referred to as evaporation plating layer) which is applied in a vacuum plating machine by means of melting and evaporating a metal such as aluminium, silver or chromium, and an overcoating layer *f* (hereinafter referred to as coating layer) which is formed by applying a liquid coating composition such as a two-liquid type urethane paint. The pressure sensitive and fusible plate is composed of laminated layers mentioned above, and the detailed structures thereof will be illustrated as follows by way of examples.

*Structural Embodiment (A):*

A laminated structure composed of a flexible aluminium foil *a* which can be plastically deformed under the injection molding pressure, an interposed binder layer *b* applied on the underside of the foil *a* and a resin film *c* which can be fused and coalesce in the matrix resin for the molded article.

*Structural Embodiment (B):*

A laminated structure composed of an aluminium foil *a*, a resin film *c* laminated underside of the foil *a* through a binder layer *b* and a coating film *d* for protecting the aluminium foil *a* and applied on the upper side of the foil through another binder layer *b*.

*Structural Embodiment (C):*

A laminated structure composed of a resin film *c* which can be fused and coalesce in the matric resin for the molded article and an evaporation plating

layer *d* applied on the upside surface of the film *c*.

*Structural Embodiment (D):*

A laminated structure composed of a resin film *c*, an evaporation plating layer *e* applied on the upside surface of the film *c*, and a coating layer *f* applied for protection on the upside surface of the evaporation plating layer *e*.

*Structural Embodiment (E):*

A laminated structure composed of a resin film *c*, an evaporation plating layer *e* applied on the upside surface of the film *c*, and a coating film *d* applied for protection on the upside surface of the evaporation plating layer *c* through a binder layer *b*.

As will be apparent from the foregoing description, the pressure sensitive and fusible plate 1 essentially comprises at its obverse or upside surface a flexible aluminium foil *a* or an evaporation plating layer *e* laminated on a resin film *c* with or without a coating layer covering the same which has a metallic color tone appearance and can be plastically deformed under the injection molding pressure, and at its reverse or underside surface a laminated resin film *c* made of a resin which is homogeneous with or has the chemical affinity with the matrix resin for the molded article and can be melted at the molding temperature to coalesce into and unite with the matrix resin concurrently with the molding operation for forming an integral body. The empirical results show that the preferable thickness of the laminated structure is less than 0.3 mm under the ordinal injection molding pressure of 300 to 500 Kg/cm$^2$ and the injection molding temperature of 200 to 270°C.

The method of making a molded article according to the invention wherein the aforementioned pressure sensitive and fusible plate is used as the insert member will now be described referring to the specific examples thereof.

*Example 1*

Referring firstly to Figures 1 to 4, there are shown the steps of molding an ornament plate having a metallic appearance and provided with embossed three dimensional patterns and letters.

Specifically, the ornament plate has a contour circle and designed letters Y and K enclosed in said circle which form a protruding or convex surface 1*a* with the surrounding and remaining surface forming a relatively recessed or concave surface 1*b*, the ornament plate being molded in a molding cavity 3' of a female mold 3 provided at the predetermined portion of its underside or bottom face with an embossment forming surface 3*a* consisting of a concave-convex part corresponding to said convex surface 1*a* and concave surface 1*b*. The aforementioned pressure sensitive and fusible plate 1 is positioned on the embossment forming surface 3*a* with its obverse surface made of the aluminium foil *a* or the evaporation plating layer *e* lying upwardly and with its reverse surface made of the resin film *c* lying upwardly. The plate 1 is inserted in the molding cavity 3' while being supported by the convex portion of the embossment forming surface 3*a* separated from the concave portion by a gap corresponding to the depth of the latter.

A male mold 4 having at its center an injection gate 5 is inserted into the molding cavity 3' of the female mold 3 to be clamped therewith, and a molten resin for forming the matrix of the molded article is injected through a sprue 6 and filled in the cavity

The present invention shall not be limited to the examples illustrated above, but may be applied for forming embossments of various shape at any over the plate 1, whereupon the plate 1 is pressed by the action of high pressure exerted by the injected filling resin to cause the part of the plate lying over the concave or recessed portion of the embossment forming surface 3*a* to be urged onto said recessed surface by the distance corresponding to said gap thereby to be deformed, whereby the plate 1 is closely abutted or fitted on the embossment forming surface and the resin film *c* is melted at the injection temperature to coalesce in the matrix 2 of the molded article to be united therewith for forming an integral body.

In the molding method just mentioned above, it is possible to produce a desired molded article shown in Figures 1 and 2 having a surface portion of inherent metallic color tone generated from the aluminium foil *a* and the evaporation plating layer *e* and three dimensionally embossed patterns and letters profiled in accordance with the embossment forming surface of the mold.

Figure 5*a* is a diagrammatical view showing the method of forming an embossment on the upside surface of a cylindrical molded article such as a cap which is molded similarly as in the preceding example.

Figures 5*b* and 5*c* show the embodiments which are molded in a similar manner as that of Figure 5*a* except in that the embossed patterns are formed on the peripheral and entire surface of the molded bodies, respectively.

*Example 2*

A required embossment forming surface is formed at the corresponding locations on the internal surface of the molding cavity of the female mold 3, and a plate 1 is inserted in the cavity along the plane of the bottom surface. The male mold 4 is clamped relative to the female mold and a molten resin is injected into the cavity formed therebetween, whereupon the plate 1 is pressed against the embossment forming surface to be deformed in agreement with the embossment forming surface under the influences of the injection pressure and temperature and concurrently to coalesce in the body or matrix of the molded article of the desired shape as shown in Figure 5*b*.

*Example 3*

Desired embossment forming surfaces are formed on the entire internal surfaces of a female mold 3 facing the molding cavity in which a plate 1 preformed by compression to have the shape generally fitted to the cavity, i.e. the cap like shape, and a male mold 4 is adjoined together and clamped. Following procedures are same as in the preceding examples to mold the article shown in Figure 5*c* in section.

*Example 4*

This example is directed to a method of forming patterns on a curved surface as shown in Figure 5*d*, e.g. on the obverse surface of a lid of a cosmetic compact, wherein a molded article is formed with

the use of a mold provided with the internal face corresponding to the curved surface in a similar manner as in Example 1.

desired locations to give molded article having the surfaces of metallic tone appearance due to the aluminium foil or the evaporation plating layer which constitute the pressure sensitive and fusible plate, the patterns and letters being freely formed as the three dimensional embossments tranversely of the concavo-convex planes, so that beautiful molded articles of original design and presented with higher grade appearances may be produced thereby.

The three dimensional pattern or letter on the surface of a molded article according to the invention appears concurrently with the injection molding step for forming the matrix or main body of the article, different from that formed by a subsidiary machining operation following to the molding step, so that the surface thus formed is integral with the main body with the plate being stably united with the plate and the insert member is united with the main body of the molded article to form integral mass to stabilize the thus formed embossed surface which is beautifully finished, tough and durable due to the fact that the film or the layer presenting the metallic appearance is made of a metal. Accordingly, there is no fear of fading or peeling off of the embossed surface which is also hardly to be scratched to permanently retain the pattern or letter stably thereon, whereby the commercial value of the molded article is considerably increased.

Further, the coating film *d* and the coating layer *f* of the embodiments for protecting the surface of the aluminium foil or the evaporation plating layer may be transparent or colored as desired to change the color tone of the surface of the molded article, whereby the design of the article may be presented with distinctly original appearance.

In the case of Example 1 wherein a generally flat surface is embossed, the pressure sensitive and fusible plate 1 may be preliminarily cut to a slip of desired dimensions prior to insert it in the cavity of the mold, or alternatively a tape-shaped plate 1 may be fed in and transfer through the cavity in synchronism with the actuation of the male mold. If the plate 1 is supplied in the latter mentioned manner, it is sheared to have a desired length to be automatically inserted in the cavity and positioned at the predetermined location resulting in improvement in the production efficiency.

## CLAIMS

1. A method of making a molded article of a synthetic resin wherein a three dimensional pattern or letter is embossed on a desired portion of the surface of said article concurrently with the injection molding operation, which comprises the steps of engraving the portion of a female mold corresponding to said pattern or letter to form an emboss forming surface, positioning on said emboss forming surface an insert member composed of a pressure sensitive and fusible plate which may be plastically deformed under the injection molding pressure and temperature adapted for injection molding said article from a matrix resin to coalesce in said matrix resin, inserting and clamping a male mold to form a molding cavity cooperatively with said female mold, and injecting said matrix resin, inserting and clamping a male mold to form a molding cavity cooperatively with said female mold, and injecting said matrix resin into said cavity, whereby an embossed pattern or letter of metallic appearance is presented on said desired portion of said article.

2. A method of making a molded article of a synthetic resin as claimed in claim 1, wherein said female mold is provided with said emboss forming surface on its bottom and/or peripheral surface or on its entire surfaces.

3. A method of making a molded article of a synthetic resin as claimed in claim 1 or 2, wherein said pressure sensitive and fusible plate is positioned on said emboss forming surface in a shape of a slip preliminarily separated to have desired dimensions.

4. A method of making a molded article of a synthetic resin as claimed in claim 1 or 2, wherein said pressure sensitive and fusible plate is fed on said emboss forming surface in a shape of a tape.

5. A method of making a molded article of a synthetic resin as claimed in claim 1 or 2, wherein said pressure sensitive plate is shaped to have a desired form prior to position the same on said emboss forming surface.

6. A method of making a molded article of a synthetic resin as claimed in claim 1, wherein said pattern or letter is embossed to form a concave plane whereas the portions surrounding said patterr i or letter being flush with the relatively recessed plane.

7. A method of making a molded article of a synthetic resin as claimed in claim 1, wherein said pattern or letter is depressed relative to the surrounding portions which embossed to form a concave portions.

8. An insert member for presenting a three dimensional pattern or letter of metallic appearance on the surface of a molded article of a synthetic resin, which comprises a pressure sensitive and fusible plate of laminated structure including a flexible metal layer having a metallic color tone and being plastically deformable under the injection molding pressure, and a layer disposed underside of said metal layer and composed of a material which may be melted at the injection molding temperature to coalesce in the matrix resin forming the main body of the article during the injection molding operation.

9. An insert member as claimed in claim 8, wherein said pressure sensitive and fusible plate has a laminated structure including an aluminium foil or plate and a resin film or plate disposed underside of said aluminium foil or plate through an interposed binder layer.

10. An insert member as claimed in claim 9, wherein a coating film is applied over said aluminium foil or plate through an interposed binder layer.

11. An insert member as claimed in claim 8, wherein said pressure sensitive and fusible plate has

a laminated structure including a layer of a resin film or plate and an evaporation plating or hot-stamped layer of metal applied on the upside surface of said resin film or plate.

12. An insert member as claimed in claim 11, wherein an overcoating layer is applied on the upside surface of said evaporation plating or hot-stamped layer of said metal.

13. An insert member as claimed in claim 11, wherein a coating film for protection is applied on the upside surface of said evaporation plating or hot-stamped layer of said metal through a binder layer.

14. An insert member as claimed in any of claims 8, 10, 12 and 13, wherein said coating film for protection or said overcoating layer is transparent or colored.

15. An insert member as claimed in any of claims 8 to 14, comprising a slip preliminarily separated to have desired dimensions.

16. An insert member as claimed in any of claims 8 to 14, comprising a continuous tape.

17. An insert member as claimed in any of claims 8 to 14, comprising a pre-formed article of desired contour.

18. A method as claimed in claim 1, substantially as hereinbefore described with reference to Figures 1 to 4 or any of Figures 5a to 5d of the accompanying drawings.

19. A molded article made by a method as claimed in any of claims 1 to 7 and 18.

20. An insert member as claimed in claim 8, substantially as hereinbefore described with reference to, and as shown in, Figure 6 of the accompanying drawings.

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